Observations on the Rate of Vibration in Ankle Clonus

BY

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Professor of Physiology in the University of Aberdeen

[Reprinted from "The British Medical Journal," November 30, 1901]

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MANY observers have found the rate of vibration in ankle clonus to be usually about 7 or 8 per second. Gowers[1] says: "The movement is very uniform, from 6 to 9 contractions per second." He recorded the movement by attaching a writing point to the foot, and causing it to inscribe its movement on a recording drum. Waller[2] describes rates of 8, 9, and 10 in three cases of paraplegia, and a rate of 10 per second in a case of spinal syphiloma. Horsley[3] found the rate to be 10 per second in a man suffering from caries of the spine. Herringham[4] observed a frequency of about 7 per second in four cases from which he made tracings.

The upper limit of the vibration frequently seems, as far as has been described, to be sharply defined. I have not been able to find any record of a rate above 10 per second, but the following observations show that this limit is by no means an absolute one, that it can be overpassed to a very marked extent, and that different modes of registration may yield different results in some instances.

A man, aged 40, suffering from hemiplegia of ten months' duration, showed greatly exaggerated "myotatic" reactions in the lower limb on the paralysed side. The knee-jerk was greatly increased; a single tap on the patellar tendon elicited several contractions in the quadriceps muscle—the condition called "tremospasm" by some observers.

When continued tension was applied to the quadriceps by traction upon the patella a well-marked clonus was set up in the muscle and continued as long as the tension was maintained. A tap upon the tendo Achillis caused a multiple response from the calf muscles, two or three twitches following the tap. When ankle clonus was elicited in the usual way the vibration of the calf muscles looked unusually rapid, and tracings made showed that it was so. A tambour (button cardiograph, &c.,) was strapped on the leg, so as to press on the calf muscles and record changes in them ; this tambour was connected in the usual way with a recording tambour, while a time tracing showing

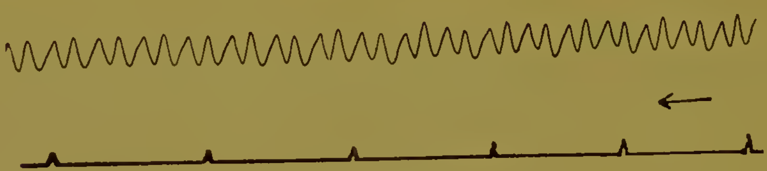

FIG. 1.

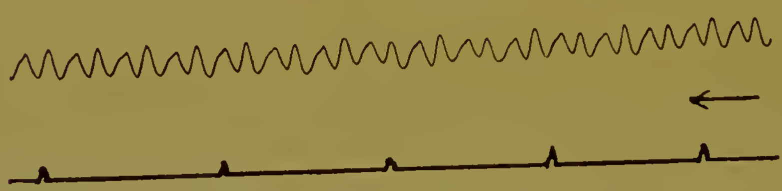

FIG. 2.

half seconds was simultaneously inscribed. The rate of vibration was found to be as a rule 13·5 or 14 per second —that is about double the rate of ankle clonus as ordinarily observed. (See fig. 1.) In fig. 2 a similar rate of vibration (14 per second) is seen, while alternate vibrations exhibit a marked difference in character, each alternate curve being broader at the base and less sharp at the apex than the intervening curves. Indications of such differences, though only slight, may be detected in fig. 1 also.

With somewhat different conditions in situation of tambour, amount of tension, &c., the differences in alternate vibrations may become very striking, so that the tracing

obtained may look like a pulse tracing with a well-marked dicrotic wave (fig. 4). Fig. 4 reproduces a portion of a tracing in which the " dicrotic " type gradually merged into the kind of tracing shown in figs. 1 and 2. At the right hand side of fig. 4 there are alternate large and small curves ; towards the left side the general characters of fig. 2 develop ; it is seen that the small alternate waves grade into the broader curves of figs. 2 and 1. In the early part of the tracing the rate is about 12 per second : in the later part 13.

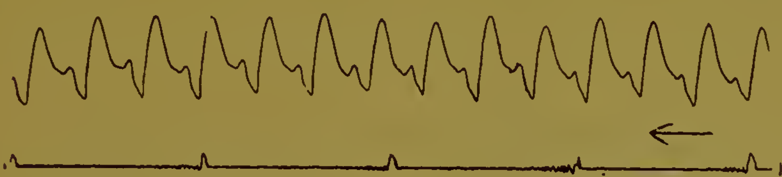

FIG. 3.

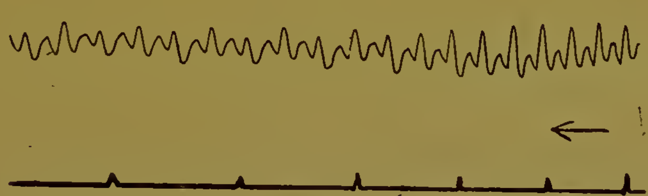

FIG. 4.

FIG. 5.

The effects of the two single taps on the tendo Achillis are shown in fig. 5 ; two well-marked twitches occur after each tap ; these twitches occupy somewhat longer time than two contractions of the ankle clonus. After the two twitches (in fig. 5) there come one or two slighter oscillations of longer duration. (Upward movement of the lever = contraction.)

Fig. 6 shows a tracing of the multiple knee-jerks caused by two separate taps on the patellar tendon recorded by a tambour strapped on over the quadriceps muscle. Three large contractions resulted in each case, coming at the rate of about 10 per second.

Fig. 7 shows the clonus excited in the quadriceps by traction on the patella ; it exhibits a rate of about 7·5 per second. It is noticeable that this clonus is decidedly slower than the rate of succession in the three well-marked contractions excited by a tap on the patellar tendon ; this is in contrast to what has been stated above in regard to

Fig. 6.

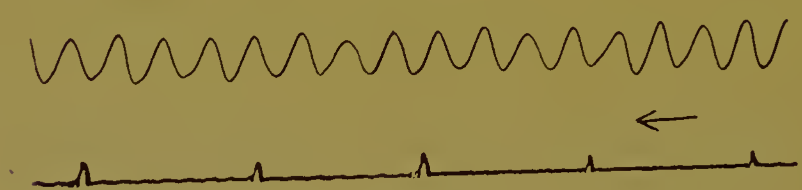

Fig. 7.

the calf muscles, where the rate of ankle clonus was somewhat higher than the rate of succession in the contractions caused by striking the tendo Achillis.

It is important to note that while a rate of 13 to 14 per second was obtained during ankle clonus when the receiving tambour was strapped on the calf muscles, a very different result was got when the movement of the foot was recorded, the button of the tambour being brought into contact with the ball of the foot while the clonus was going on. The vibration shown was only half as fast (see fig. 8). In some instances simple large curves at this rate occurred ; in

other instances the large curves described by the foot movement were noticed at the top, indicating a probable fusion of two vibrations into one large curve. Thus, it is evident that the large movements executed by the foot are by no means necessarily a true indication of the actual vibration in the calf muscles.

The tendency to fusion which sometimes exists in cases of tremor was pointed out by Dawson Williams and Wolfenden,[5] who examined cases of paralysis agitans, disseminated sclerosis, &c., by placing the hand (fingers or palm) on an india-rubber bag connected with a recording

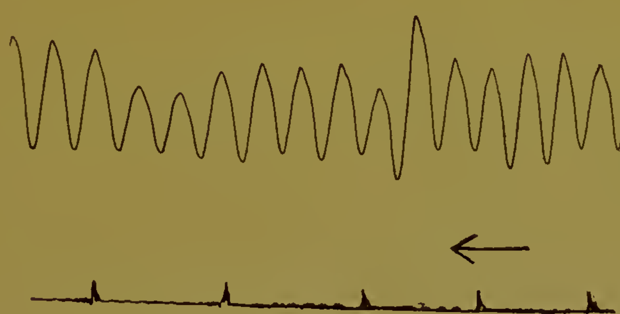

Fig 8.

tambour. In a case of paralysis agitans they obtained large curves at the rate of 5·1 per second ; these were notched at the summit, indicating a true rate of 10·2. So in disseminated sclerosis giving 5·2 large waves per second there was evidence of secondary waves, pointing to a true rate of 10·4 In some tracings they noted alternate smaller waves, recalling the appearances seen in a tracing of a "dicrotic" pulse. Herringham[6] also noted the tendency to fusion in some tremors.

It is hardly necessary to remark that I do not affirm the occurrence of fusion in ankle clonus generally, but only that such may occur, as in the case described above, and that the foot movement may only show half the real rate of vibration in the muscle.

So high a rate of vibration in ankle clonus as 14 per

second is interesting in regard to its relation to the character of the discharge, tonic influence, &c., from the motor cells of the spinal cord. Horsley and Schäfer[7] state that the automatic action of the nerve-cells of the cord appears to be never capable of originating a rhythm of greater frequency than 10 per second. But while we know that the integrity of the spinal cord is essential for the occurrence of ankle clonus and cognate phenomena, we have no definite knowledge as to what relation the cord bears to the rate of vibration.

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